EM SSAB Teleconference: 1. DOE EM ITR Landfill Assessment Project: Lessons Learned

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Independent Technical Review Team

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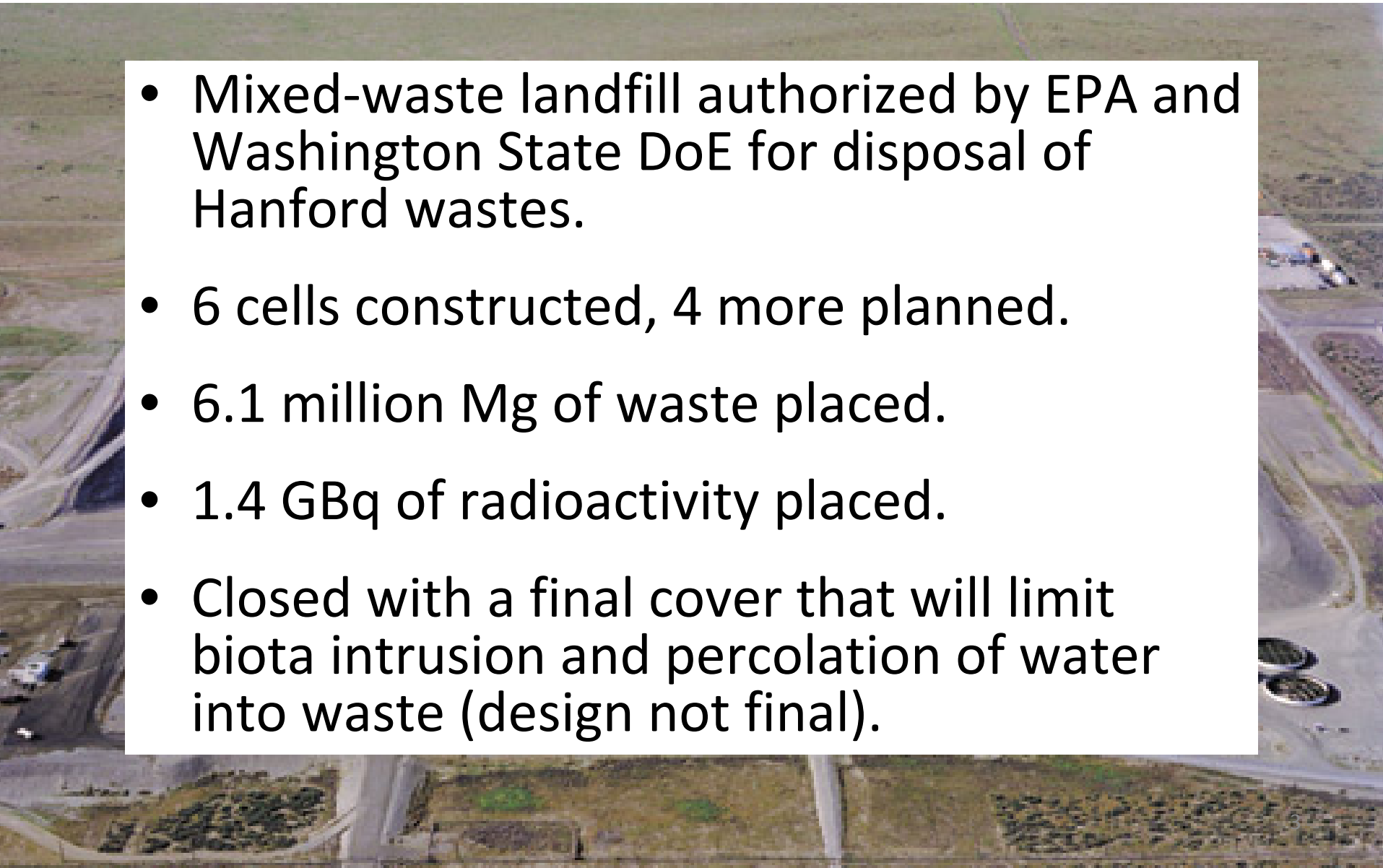
How did we get started?
Hanford Irregularities Prompting Review



- Mixed-waste landfill authorized by EPA and Washington State DoE for disposal of Hanford wastes.
- 6 cells constructed, 4 more planned.
- 6.1 million Mg of waste placed.
- 1.4 GBq of radioactivity placed.
- Closed with a final cover that will limit biota intrusion and percolation of water into waste (design not final).

How did we get started?
Hanford Irregularities Prompting Review

- Issues with waste placement and compaction (falsified density test data, compactor weight issues, soil-debris ratio, etc.).

- Leachate pump failure and excessive leachate head.

- Administrative concerns regarding these problems, especially the time period over which they went un-noticed.

Other Sites

- Idaho CERCLA Disposal Facility (October 2007).
- Oak Ridge's Environmental Management Waste Management Facility (December 2007).
- Portsmouth Gaseous Diffusion Plant On-Site Waste Disposal Facility (January 2008)
- Nevada Test Site (April 2008)
- Paducah Gaseous Diffusion Plant (May 2008)
- Savannah River Site (June 2008)

ITR Charter

Independently evaluate existing practices at DOE on-site disposal facilities to assess:

- issues that could impact the ability to meet performance objectives.
- cost-effective lessons learned that may improve reliability and effectiveness of DOE on-site disposal facilities.

Consider technical, regulatory, and management issues.

Provide advice and recommendations helpful to DOE sites and HQ.

Hanford Lessons Learned - 1

- Performance-based specifications and automated compaction equipment permit better control of compaction operations and monitoring than conventional manual methods.
- Automation (e.g., compaction monitoring, leachate monitoring) reduces reliance on human factors for effective operations.
- Flexible cap provides better protection from unforeseen and uneven landfill settlements; greater confidence for compliance with long design life.
- Settlement of waste is difficult to predict and yet is key to providing a firm foundation is key to successful long-term performance of the surface barrier (cap).

Hanford Lessons Learned – 2

- Many DOE landfills have been designed very conservatively and do not account for the effectiveness of modern barrier systems. Reviewing this policy and reconsidering PAs may permit more cost-effective operations.

- Long-term performance of landfills is important issue for long-term stewardship. Urgent need for more information regarding performance of barrier systems over various time-scales.

- EM manages large and long-term projects that may take decades to complete. Methods and specifications developed early on may not be relevant or efficient in later years. Periodic review and updating of methods and specifications recommended.

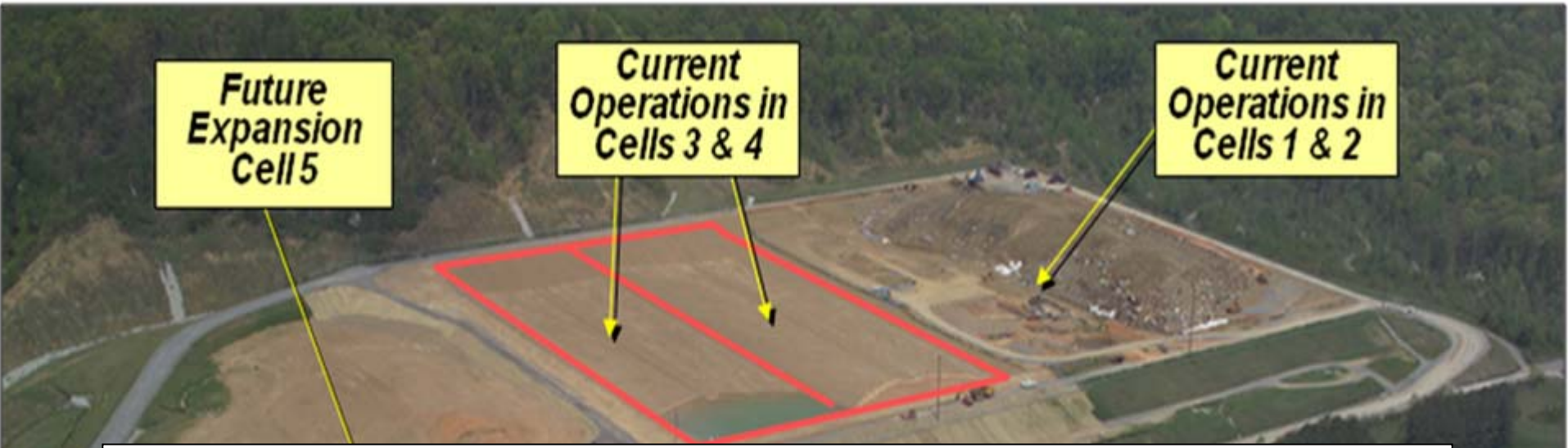
Idaho CERCLA Disposal Facility

- Landfill for disposal of solid waste
- Evaporation pond to manage landfill leachate and aqueous wastes (8.3 million L capacity)
- Staging and treatment facility
- Landfill capacity = 390,000 m^3

Idaho Lessons Learned

- Uniformity and completeness of container grouting difficult to assess. Need independent method to verify voids have been filled.
- Like Hanford, performance-based method for compaction control could be used advantageously in lieu of conventional manual testing.
- Landfill Compaction/Subsidence Study be re-evaluated and consider impacts of differential settlement caused by variations in stiffness, collapse of voids, and long-term creep settlement.
- Consider various alternatives (surface reinforcement, preloading etc.) if differential subsidence is problematic.

Oak Ridge's EMWMF



- Landfill for disposal of solid waste, RCRA C hazardous wastes, TSCA wastes, mixed wastes
- Landfill capacity = 1,300,000 m^3
- Cells 1-4 operational, capacity = 920,000 m^3.
- Cell 5 construction to begin October '08, operational by October '10.

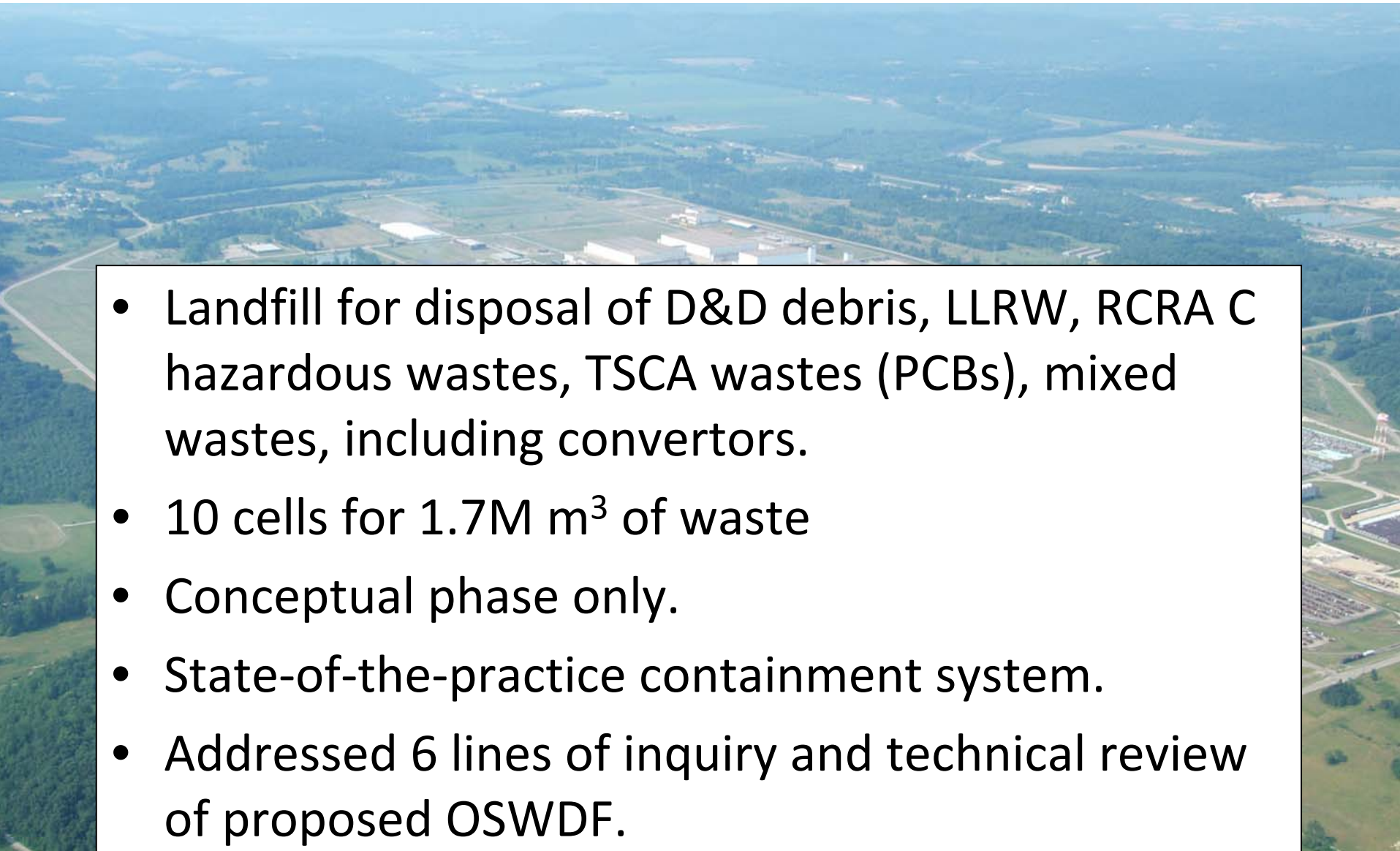
Oak Ridge Lessons Learned - 1

- Continue to develop waste volume forecasting methods. Be strategic for phasing cell construction (e.g., staging wastes) and landfill expansions if necessary.
- Electronic monitoring systems for waste tracking, control, record keeping (automation) make forecasting more reliable and efficient.
- Employ strategies that directly address stakeholder concerns (tech guidance documents, dedicated haul roads, trust funds for perpetual care).

Oak Ridge Lessons Learned - 2

- Re-evaluate compaction criterion, control methods, and cover settlement evaluation. Tie these issues together quantitatively. Develop strategies to limit use of nuclear densometer for compaction testing.
- Revisit conservative assumptions made for liner systems to account directly for the attenuation capacity inherent in modern liner materials.

Portsmouth Gaseous Diffusion Plant



- Landfill for disposal of D&D debris, LLRW, RCRA C hazardous wastes, TSCA wastes (PCBs), mixed wastes, including convertors.
- 10 cells for 1.7M m^3 of waste
- Conceptual phase only.
- State-of-the-practice containment system.
- Addressed 6 lines of inquiry and technical review of proposed OSWDF.

Portsmouth Lessons Learned - 1

- Engaging stakeholders and addressing stakeholder concerns is a key to success. Entire process needs to be transparent. Project team must be diligent in describing all controversial elements.

- Strong operating record of engineered on-site disposal facilities in DOE complex can helpful in decision-making process. DOE should document history of their engineered on-site disposal facilities and compare the risks to other disposal and management options.

Portsmouth Lessons Learned - 2

- Waste placement must result in tolerable differential settlements over 1000 yr. Link waste settlement, cover performance, and long-term performance requirements. Large void spaces from convertors may be problematic.

- Field test compaction methodology and try innovative compaction technologies (performance based methods, intelligent compaction).

- Dedicated haul road should be considered to avoid waste transport over public roadways.

Nevada Test Site

Photo courtesy J. Carilli, NTS

300-ha facility where LLRW and mixed LLRW disposed in shallow (3-15 m deep) unlined trenches and pits.

Commenced operations in 1961; accepting off-site waste since 1976.

> 400,000 m^3 of LLRW and 8600 m^3 of MLLW disposed in the existing (160 ac) developed area.

~3 million m^3 remaining capacity within 740 ac footprint of Area 5.

Mixed waste unit to be closed in 2011 or when the capacity (20,000 m^3) is reached. New facility needs to be permitted if mixed wastes to be disposed after 2011.

NTS Lessons Learned

- Past NTS cover studies should be reviewed in the context of current knowledgebase to be sure that conclusions are consistent with current scientific thinking within and external to DOE.

- NTS should carefully review merits of unlined and lined landfills through an unbiased comparative expert assessment prior to embarking on developing new facilities. Experts with and without DOE experience should be involved in this assessment.

- NTS should explore where automation can be applied as part of waste acceptance, landfilling operations, and record keeping.

- NTS should develop a lessons-learned document or webinar on good practices for stakeholder interaction that could be shared with other DOE site managers.

Paducah Gaseous Diffusion Plant

Active U enrichment facility operated by US Enrichment Corporation.

Placed on National Priorities List in 1994 (CERCLA action).

Remediation may include OSDF meeting CERCLA ARARs (effectively RCRA Subtitle C landfill) & DOE Order 435.1.

No preliminary design for OSDF is proposed.

Paducah Lessons Learned - 1

- Brownfield site is most logical and compelling location for OSDF. Propose innovative monitoring schemes that permit monitoring directly beneath OSDF.
- Risk of public exposure during controlled recreational activities is extremely small. Public-use strategy should preclude public access to areas with appurtenances and should prevent disturbance of cover.
- Review and comparison of the proposed and actual baseline schedules at Fernald and PGDP by DOE personnel is recommended.
- DOE should develop lessons learned documents on scheduling, stakeholder interactions, etc.

Savannah River Site

Disposal operations at (SRS) for more than 50 yr.

Active disposal areas are located in the E Area.

Only LLRW is disposed at SRS.

S. Carolina and US EPA do *not* have regulatory authority. DOE does keep them informed.

Savannah Lessons Learned - 1

- Significant uncertainties associated with trench discharge that are difficult to evaluate with models. Consider large-scale measurements of flux from actual or simulated trenches. Consider inverse analysis of old disposal units.

- Differential settlement at edges of narrow trenches may be problematic. Evaluate potential for differential settlement via field testing and analysis.

- Un-conservative assumptions regarding barrier properties in cover. Re-evaluate cover profile and percolation rates assumed in the PA. Conduct field experiments on proposed cover to evaluate performance.

Savannah Lessons Learned - 2

- Delaying installation of final cover and use of temporary geomembranes for isolation during the institutional control period. Allows waste to settle before cover constructed.

- Use of deep dynamic compaction to stabilize waste; will reduce settlement problems.

- Waste Information Tracking System (WITS) – consider adopting this system as a complex-wide methodology.

- Groundwater model consistency team – consider adopting similar complex-wide philosophy.

Lessons Learned: Universal Questions

- Waste subsidence/settlement – impact on long-term performance of cover; how to predict and prevent.
- Waste characterization/sequencing – estimating air space requirements and optimizing use.
- Long-term cover performance – final cover responsible for long-term containment; how function of 1000 yr period?
- Liners – Are liners needed? For which climates, hydrogeological conditions, and waste forms?

Performance Expectations

- On-site disposal facilities expected to function for at least 1000 yr
- Huge engineering goal and accomplishment
- Requires close attention to engineering behavior than in conventional infrastructure
- May require **unconventional** engineering or approaches.